Creating more Value out of Storage

By Gary Howorth,   Founder Energy-Redefined

Introduction

Gas Storage is a complicated business which carries with it large risks and potentially low rewards. Assets can operate with low margins for many years but typically make large profits in worse than average winters or summers. Of course it is difficult to predict when these will occur, which results in risk profiles that many operators cannot or want to bear.

The commercial and physical performance of these assets depends on many factors but is location, type, and geology specific. Over the next 20 years it is estimated that some 600 -700 bcf[1] of new storage will be required, but of course this is a function of the overall demand growth. This equates to some 30 -35 bcf of new additions every year. In recent years there has been a lack of new storage investments. The question is:

- What is driving this lack of interest – is it regulatory or price related or something else
- What changes might need to be made to the market structure to improve the investment characteristics of the industry
- Who will benefit and how?

Regulated vs Unregulated Storage

Storage assets in the US are either regulated or unregulated (market based). FERC2 has jurisdiction over any integrated underground storage assets that are owned by an interstate pipelines and also any independently owned storage asset providing interstate services is also under this jurisdiction.

The addition of storage assets within some of these regions can have significant effects on seasonal

[1] Based ion today's market characteristics. With higher demand and or lower efficiency scenarios or a different view on security of supply this number could be significantly higher.
[2] Federal Energy Regulatory Commission

prices. This brings with it the potential for manipulation of these prices by the owners of these assets or at least the perception of this. To determine whether or not the asset should be regulated various market tests have been developed by FERC. Essentially this is based on a test, which looks at market power and the ability to significantly increase prices or unfairly discriminate in terms of prices or conditions.

Where the assets are regulated there is considerable flexibility in the way that the FERC allows the design of the cost based or regulated rates, but more of this later.

Costs of Storage

Costs of storage vary greatly by region, by type (e.g. Salt cavern vs depleted reservoir vs aquifer), by size, by duration[3] and by geology. It is not the intention of this note to estimate the costs of these but to provide some indications of what the costs might be like. Our analysis on typical Salt cavern storage sites indicates that the costs of these range from $2.00 – $3.00 in the gulf coast.

Gulf coast based reservoirs are cheaper than reservoirs based in the Northeast by a factor of 2 -2 .5. Of course expansion options available to existing operators maybe significant less than this. Note also that most regulated – “cost of service” storage is based on depleted reservoirs which are inherently cheaper than salt cavern storage, but less flexible

For a typical new salt cavern storage site we have used a cost of $2.30/mmbtu[4]. We will be using this benchmark in later sections.

The Value of Storage

Storage can be valued in many different ways from the more traditional method of cost plus to more sophisticated methods based on option theory.

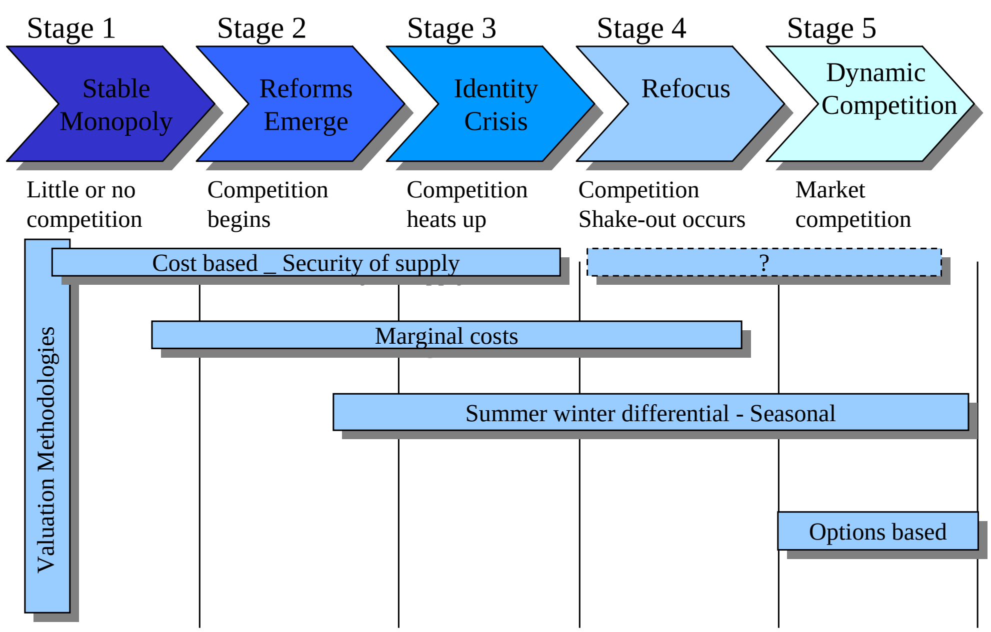
- Cost plus based
- Alternatives based
- Summer winter differentials
- Options based – Simple

[3] Duration – Number of days the storage is expected to operate
[4] Pre tax and assuming a 10 bcf working storage reservoir

➢ Options based – complex – multiple assets

Typically these evaluations follow, the development of the market with the more complex techniques being used in the more mature dynamic/competitive markets.

Stages of Competition: Gas Storage



In the context of the mature US market , some local region characteristics dictate that they by necessity operate essentially as stable monopoly's -

It is not our intention to discuss the regulated methodologies but suggest later that these owners will allowed to earn return a 12% rate of return. Of course it could be more or less depending on the actual arrangement with FERC.

In the context of the other methodologies (Summer Winter differentials & Options – which are more market based) we will now discuss these in turn to determine whether or not the market provides adequate signals for Greenfield storage investments

Market conditions – Summer Winter differentials.

In very simple terms if one could buy gas at a low price, store it and sell it later at higher prices (October – February), there is a potential to make a profit. Let's suppose that we do this once during the year – storing gas between March and September and withdrawing it between October and February.

If the spread between these prices is higher than the cost of the storage there is a potential to make money. Of course this spread should be large enough to justify the risk that prices are not high enough to cover the costs.

Current average spreads between Summer/winter are around 60 cents. It is clear that this summer winter spread is not sufficient to cover the new build costs presented above.

The Value of Optionality

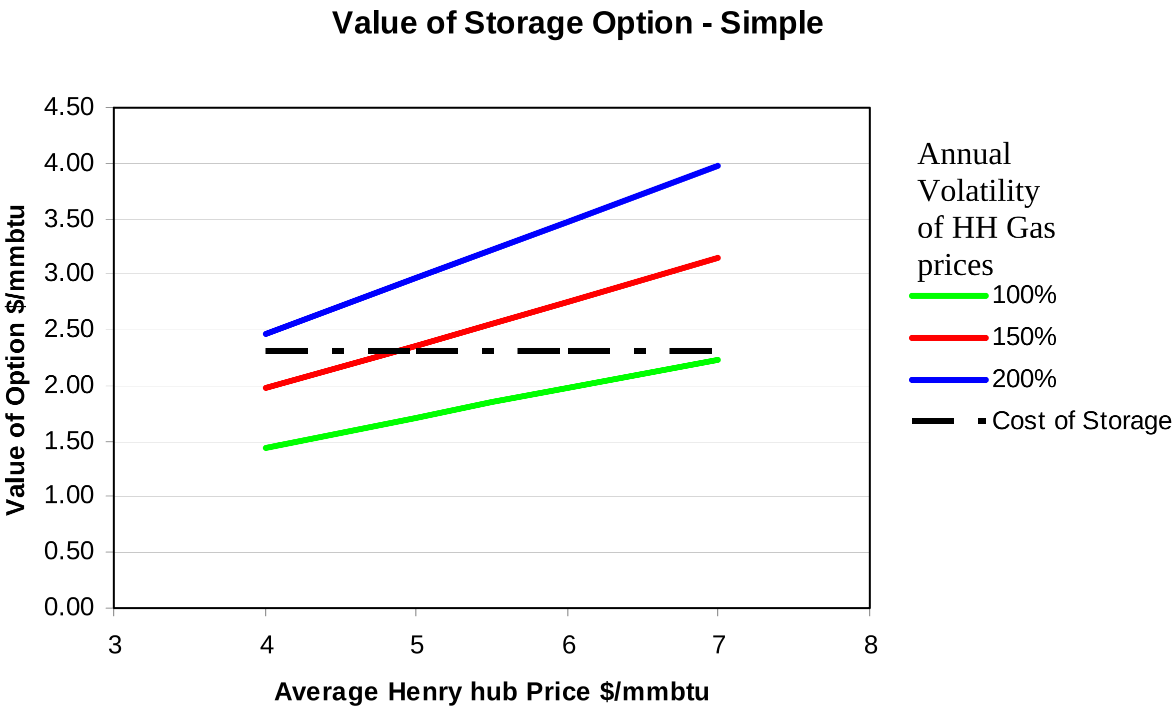
High deliverability storage which can cycle many times throughout the years eg salt caverns, can provide additional opportunities to trade over and above the example above. This type of storage typically injects and withdraws throughout the season up to 10 times. The storage can be thought of as a call option on a time spread. It can be thought of as the obligation to inject at one time and withdraw at another, throughout the season. The value of this option as proportional to:

- Future prices
- Price volatility,
- Time
- Storage Costs
- Purchase cost of gas

Assuming that storage operators execute on all of these opportunities/options the additional value over the seasonal or summer winter differential approach can be up to 2 – 3 times more depending on assumptions. Unfortunately the type of storage required to capture this benefit only makes up around 6% of the total storage capacity in existence.

Energy-Redefined estimates that the theoretical value of this approach provides a value of around $1.80 - $2.00/mmbtu on current market conditions. The market may not of course pay this. Again this appears not to cover the underlying costs of the Greenfield storage!

This value is heavily dependent upon the volatility of the market. It is our view that this volatility will increase through time, because of underlying market fundamentals.



This will help to strengthen the value associated with this approach. We estimate at best though it is likely to breakeven.

Regulatory Solutions – Conventional Wisdom?

So it appears from the above analysis that current market signals do not provide adequate Greenfield investment incentives. Conventional wisdom therefore leads you to suppose that regulatory intervention will be required if the US is to meet its objective of providing 600- 700 bcf of new storage.

FERC has been talking about changing these regulations to attract investors, including flexibility in developing tariff rates (on and off peak), changes in the market power tests and the use of auctions. The use of voluntary auctions can be used in both the regulatory and market based regimes. They can be efficient mechanisms for the allocation of storage assets and also as a way to mitigate the effects of market power. Unfortunately as the experience has shown in the UK, players in the market are not always interested in the auction and that prices bid typically levitate either to the reserve price (lower end) or to the cost of alternatives at the higher end. This behavior is typically driven by the weather conditions in the preceding year or by other events a few months before the auction date. Interestingly it is difficult because of this behavior to get market participants to commit to long term contracts as in the case of pipeline owners (another mechanism for mitigating storage owner risk).

In the context of auctions, it is likely to favor the specialist low cost storage players, as they will in theory be able to underbid less competitive players. This is not likely to be a larger oil and gas company.

LNG and Salt Cavern Storage - Freeport Mcmoran – A New Paradigm

Under the so called Bishop process, LNG can be directly received from a LNG tanker, regassified ,warmed and pressurized and injected to a underground salt cavern. The DOE believes there are some two dozen of these reservoirs within easy access offshore. "Initial indications are that a salt cavern-based LNG terminal could be built much faster than a conventional tank terminal at about half the cost and with twice the capacity" 5

Interesting Freeport McMoRan is currently engaged in the permitting process for the Main Pass Energy Hub offshore Louisiana in the Gulf of Mexico, based on such a scheme. The offshore terminal received a "Final Environmental Impact Statement" from the US Coast Guard in March of 2005. The project, as with several offshore planned terminals, has generated some environmental concern regarding the Open Rack Vaporizer regasification process, but the issuance of the FEIS appears to signify that this aspect of the project is not likely to be a major obstacle. The terminal will be constructed on existing offshore platform infrastructure, which is expected to save considerably in terms of cost of development. The project design envisions a baseload LNG deliverability capacity of 1 bcfd, with a max capability of 1.6 bcfd. The terminal will also save on costs compared to traditional terminal developments by constructing only one LNG storage tank (145,000 cm). This storage will be supplemented by development of 28 bcf of gas storage in the adjacent sub-sea salt caverns, located on an abandoned sulphur mining facility. Total peak gas deliverability (including LNG facility and salt cavern storage outlet) will be approximately 3.1 bcfd. The offshore facility (38 miles east of Venice, LA) is in close proximity to a number of existing offshore gas pipelines with the potential to access major markets across the US.

A major uncertainty for the terminal project development remains securing LNG supply. Freeport McMoRan has been in talks with several LNG suppliers but has yet to line up a dedicated LNG source. In mid-2004, the firm signed an MOU with the government of Trinidad with the intention to investigate options for supplying the terminal (as well as the possibility of Trinidad taking equity in the terminal). It is uncertain whether that initial agreement has or will move any further, with a concrete plan for a fifth train yet to be finalized. Securing long-term LNG supplies has been an issue that has plagued several North American LNG terminal developers recently, and this may put in jeopardy the Main Pass Energy plan to begin operations before the end of this decade. But ………

The cost of this scheme is reportedly some $600m, some $100m more than an equivalent regas terminal of similar size. Interestingly one could view this a different way. The salt cavern storage

[5] DOE

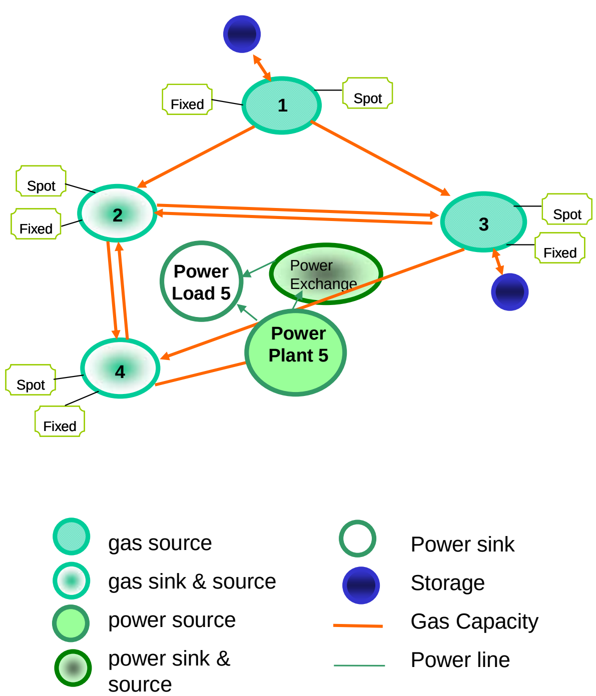
when built with the LNG regassification plant effectively reduces the cost of the salt cavern storage by 50 -70%. Of course this depends on how we want to apportion or account for the savings. This makes this salt cavern storage very attractive compared to other new build storage sites

An Alternative View

Interestingly the Freeport Mcmoran example above is an interesting first step to an alternative model for storage. This example involves one LNG regas asset and one storage asset. It in effect cross subsidizes regass and storage costs and provides an interesting combination and increased optionality. But it lacks supply but more importantly supply flexibility!!

In the next example we complicate the situation by increasing the interaction between a number of assets, LNG supply, regas, power, pipeline capacity rights etc etc

Network of Assets...



We have estimated using a proprietary approach the value of this assumed portfolio of assets.

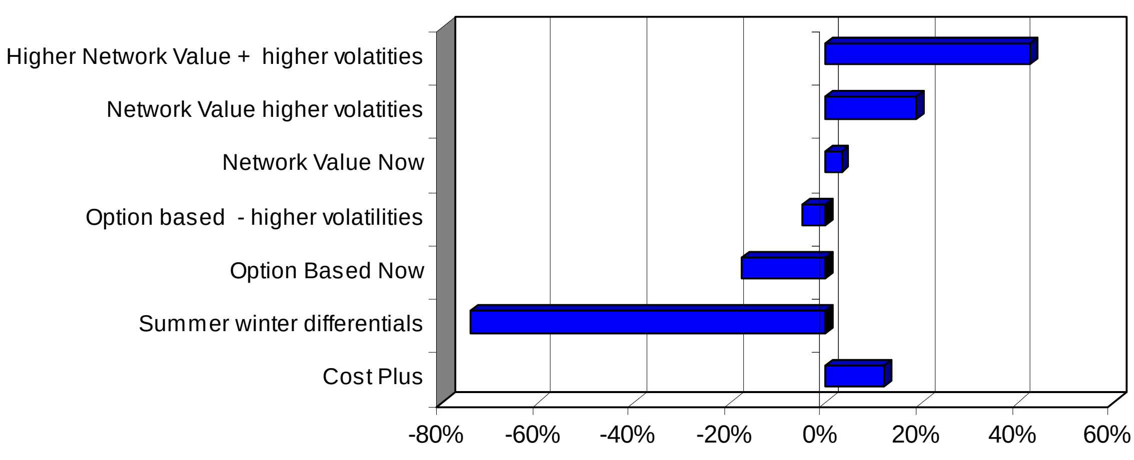
In this example we see that this network approach could yield an additional 25% more over the traditional valuation of the storage asset as an option. Of course this depends on the portfolio, the markets, volatilities and so on. We have seen other examples that might yield much more.

So what does this mean? Lets use the numbers that we have already presented and assume an average cost of storage of $2.30/mmbtu. The table and figure below estimate the profit of these various approaches both in $/mmbtu terms and percentage terms. We have included some additional cases assuming higher network values based on a boost in value of 50% not 25%. We have used volatilities in some cases 50% higher than t hose seen currently.

Valuation Method	**Profit $/mmbtu**	**% Profit**
Cost Plus	0.28	12.0%
Summer winter differentials	-1.70	-73.9%
Option Based Now	-0.40	-17.4%
Option based - higher volatilities	-0.12	-5.0%
Network Value Now	0.08	3.3%
Network Value higher volatities	0.43	18.8%
Higher Network Value + higher volatities	0.98	42.5%

Note that we have assumed that in the cost plus case a 12% return will be obtained. More sophisticated trading techniques may carry a higher risk profile than this case and therefore may typically look for a 20% return on investments.

Storage Profits



It is apparent from this analysis that this network approach may incentivize storage investors, but that will need to be storage investors with access to a wide range of assets. Of course higher cost storage schemes may still not be incentivized enough.

Summary

There is obviously a need for storage over the longer term - some 600 -700 bcf by 2025, some 30 - 35bcf of new storage per year. It appears however that there are currently insufficient regulated or market based signals to justify much of this required investment. Returns can be low and the risks high.

Conventional wisdom (asset based thinking) leads you to think that this will require a change in the regulation, so that required investments can be made. Conventional wisdom also leads one to the conclusion that:

- Where players can invest in other assets (oil fields , gas fields LNG) with higher returns and in many cases lowers risks, it makes no sense for them to invest in Storage assets in the US.
- Changes in regulation are likely to suit specialized Storage asset owners than oil and gas companies

An alternative approach based on viewing assets as a collection of networks may lead you to a different conclusion. In this world oil and gas majors or companies with a collection of interlinked assets may be in a better position to develop this storage.

If you would like to know more contact Gary Howorth at gary.howorth@energy-redefined.com

April 2009